Tatiara PWA

Unconfined aquifer

2015 Groundwater level and salinity status report

Government of South Australia
Department of Environment,
Water and Natural Resources

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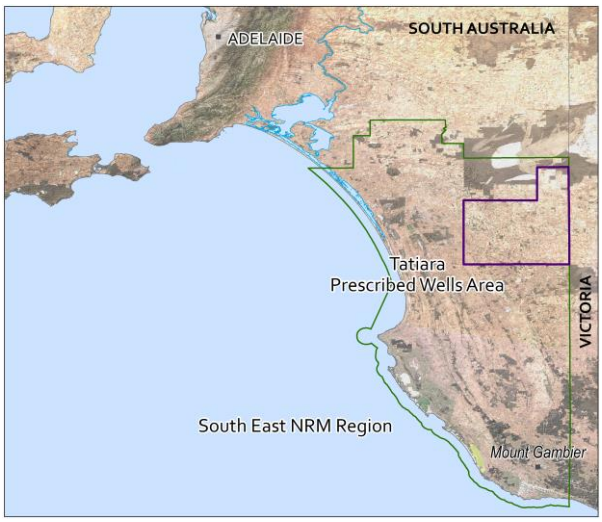
2015 Summary



The Tatiara Prescribed Wells Area (PWA) is located in the South East NRM Region of South Australia, approximately 200 km south-east of Adelaide. It is a regional-scale resource for which groundwater is prescribed under South Australia's *Natural Resources Management Act 2004*. A water allocation plan provides for the sustainable use of the groundwater resources.

The Tatiara PWA is underlain by sediments of the Murray Basin and can be divided topographically into two discrete landforms, each with different hydrogeological characteristics and groundwater management issues: low-lying plains to the west, and highlands located to the east. Both landforms are underlain by two aquifer systems—an unconfined aquifer comprising various Quaternary and Tertiary limestones, sands and sandstones, and an underlying confined Tertiary sand aquifer.

The Quaternary-aged Padthaway, Coomandook and Bridgewater Formations form the unconfined aquifer on the plains. In the highlands, the Tertiary-aged Murray Group limestone forms the unconfined aquifer. The main sources of recharge to the unconfined aquifer are direct infiltration of rainfall, groundwater flow from east to west, and point source recharge to sinkhole or runaway holes.

Trends in groundwater levels and salinity in the Tatiara PWA are primarily climate driven: below-average rainfall results in a reduction in recharge to the aquifers. Below-average summer rainfall can also result in increased irrigation extraction, and combined can cause groundwater levels to fall and salinity to rise. Conversely, increased rainfall may result in increased recharge, decreased irrigation extraction and a rise in groundwater levels, which may cause groundwater salinity to stabilise or decline. Groundwater level and salinity trends have also been affected by the clearance of native vegetation and subsequent land-use change and recycling of irrigation drainage water. The response of groundwater levels of the unconfined aquifer to rainfall varies between the plains and highlands primarily due to the depth to the watertable and lithology of the sediments (clay content). The shallow watertable on the low-lying plains is strongly influenced by the timing and magnitude of rainfall events. In the highlands, the watertable is more than 10 m below the surface resulting in a delayed response, with a lag time dependent on the depth to the watertable, type of land use and permeability of the sediments.

Keith rainfall station (BoM station 25507), located in the west of the Tatiara PWA, recorded 276 mm of rainfall in the 2014–15 water-use year. This is considerably lower than the long-term average annual rainfall of 460 mm (1900–2015) and the five-year average annual rainfall of 426 mm (Figs. 1 and 2). A decline in annual rainfall can be seen over the past five years (Fig. 2).

Licensed groundwater extractions (excluding stock and domestic use) totalled 100 783 ML[1] in 2014–15 (Fig. 3), a 33% increase from the previous water-use year and 73% of the total allocation volume for the Tatiara PWA. An increase in groundwater extraction can be seen over the past five years (Fig. 3), most likely as a result of the declining rainfall.

Long-term monitoring data show groundwater levels on the plains were stable until 1996. Since then, groundwater levels have declined by up to five metres. This corresponds to a prolonged period of below-average rainfall, however above-average rainfall from 2009 to 2011 resulted in some stabilisation of groundwater levels. In the five years to 2015, all monitoring wells on the plains and low-lying areas of the highlands (Stirling, Willalooka, North Pendleton and Wirrega Management Areas) show a declining groundwater level trend. Declines ranged between 0.02 and 0.29 m/y, with a median of 0.13 m/y. Nearly half of these monitoring wells (48%) recorded their lowest groundwater level in 2015 (Fig. 4). This corresponds with a decline in rainfall and a rise in groundwater extractions over this period (Figs. 2 and 3).

In the highlands (Shaugh, Cannawigara, Zone 8A and Tatiara Management Areas), widespread clearance of native vegetation resulted in increased recharge rates and a subsequent rise in groundwater level that persisted for several years after a prolonged period of below-average rainfall that commenced in the mid-1990s. Most monitoring wells display stable or declining groundwater

[1] The licensed groundwater use for the 2014–15 water-use year is based on the best data available as of March 2016 and may be subject to change, as approximately three per cent of South East annual water use reports had not been submitted at that time. As such, the total licensed groundwater use may be higher than the volume presented in this report.

levels since the mid-2000s in response to below-average rainfall. In the five years to 2015, 56% of monitoring wells recorded declining groundwater level trends ranging from 0.02 to 0.1 m/y with a median of 0.03 m/y (Fig. 4). The remaining 44% of monitoring wells in this area recorded stable groundwater levels or a rising trend. Fifteen per cent recorded their lowest groundwater level on record in 2015.

Groundwater salinity ranges from less than 300 mg/L west of Bordertown in the Wirrega Management Area, to nearly 12 000 mg/L on the plains (Fig. 5).

Long-term groundwater salinity trends on the plains and low-lying areas are variable. Many monitoring wells display a long-term trend of rising salinity due to the recycling of irrigation drainage water to the shallow unconfined aquifer. However, some monitoring wells on the eastern margin of the plains and low-lying areas reveal trends of stabilising or decreasing salinity since the late 1990s from point recharge to solution features such as sinkholes and runaway holes. In the five years to 2015, 76% of monitoring wells on the plains and low-lying areas recorded stable salinity (Fig. 6). Of the remaining wells, half recorded rising salinity trends, while the other half had a decreasing salinity trend.

Groundwater salinity trends in the highlands are variable. The widespread clearance of native vegetation has resulted in increased recharge rates and the flushing of salt, which was previously stored in the root zone of the native vegetation, down to the watertable. This process occurs independently of any irrigation activity, although drainage from irrigated areas will accelerate the process locally. However, in the east where the depth to the watertable is more than 30 m, stable salinities have been observed. In the five years to 2015, all monitoring wells in the highlands recorded stable salinity (Fig. 6).

To determine the status of the unconfined aquifer for 2015, the trends in groundwater level and salinity over the past five years (2011 to 2015, inclusive) were analysed, in contrast to the year-to-year assessments that have been used in past *Groundwater level and salinity status reports*. Please visit the Frequently Asked Questions on the *Water Resource Assessments* page on WaterConnect for more detail on the current method of evaluating the status of groundwater resources.

Highlands

The unconfined aquifer of the highlands in the Tatiara PWA has been assigned a yellow status for 2015:

2015 Status Minor adverse trends have been observed over the past five years

The 2015 status for the highlands is based on:

- over half of monitoring wells (56%) recording a declining five-year groundwater level trend, with 15% recording their lowest groundwater level on record in 2015.

Plains and low-lying areas of the highlands

The unconfined aquifer of the plains and low-lying areas of the Tatiara PWA has been assigned an orange status for 2015:

2015 Status  Moderate adverse trends have been observed over the past five years

The 2015 status for the plains and low-lying areas is based on:

- all monitoring wells recording a declining five-year groundwater level trend, with 48% recording their lowest groundwater level on record in 2015.

To view descriptions for all status symbols, please visit the *Water Resource Assessments* page on WaterConnect.

To view the Tatiara *PWA Groundwater Level and Salinity Status Report 2011*, which includes background information on hydrogeology, rainfall and relevant groundwater-dependent ecosystems, please visit the *Water Resource Assessments* page on WaterConnect.

To view or download groundwater level and salinity data from wells within the Tatiara PWA, please visit Groundwater Data on WaterConnect.

For further details about the Tatiara PWA, please see the *Water Allocation Plan for the Tatiara Prescribed Wells Area* on the Natural Resources South East website.

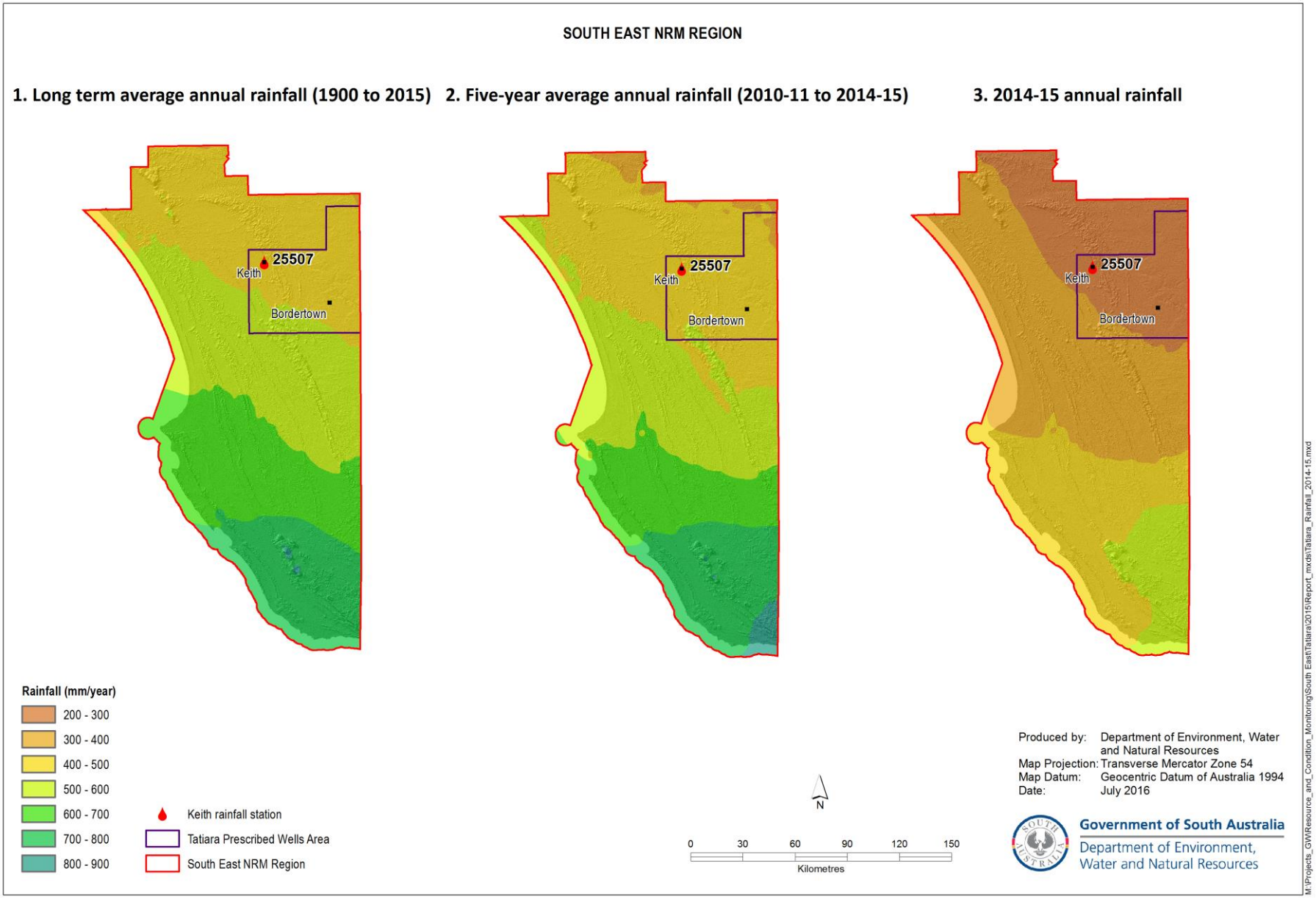


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2014–15 water-use year in the South East NRM Region[2]

[2] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

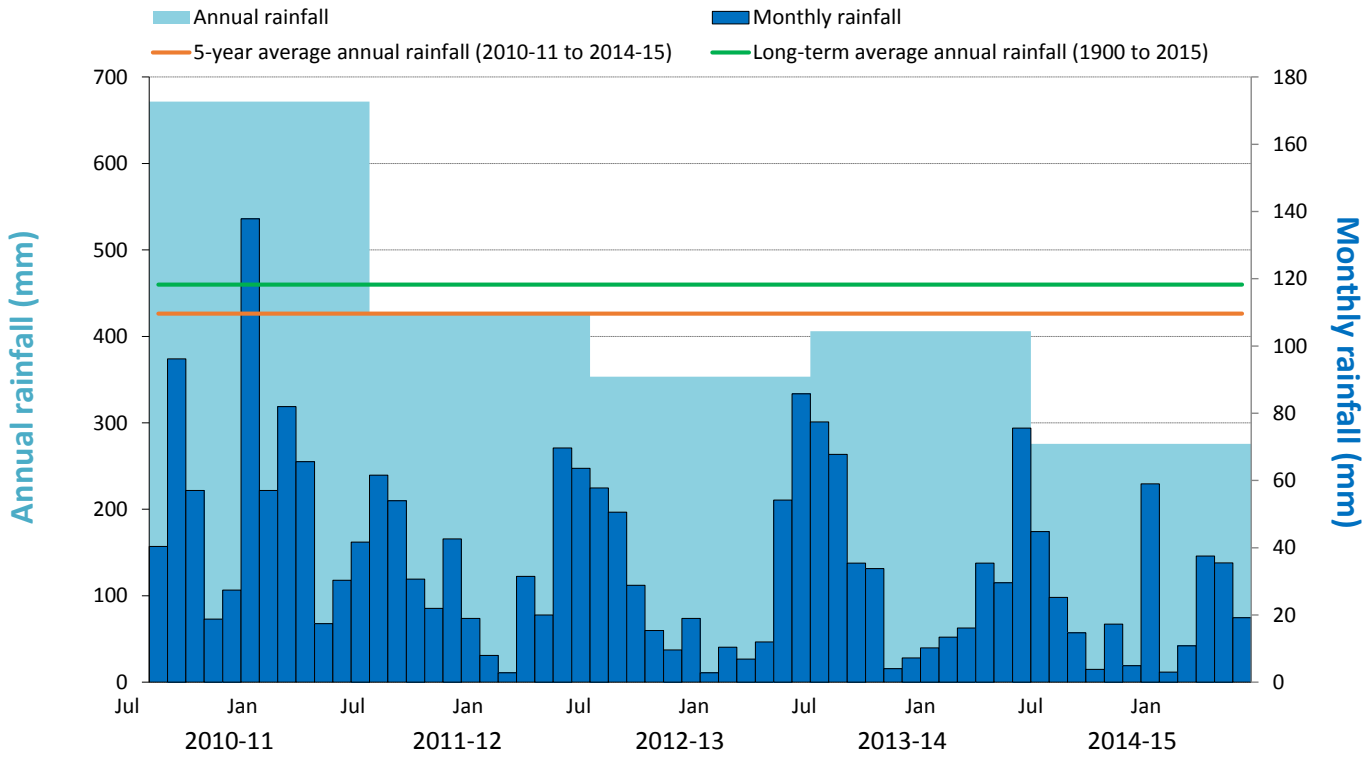


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Keith (BoM station 25507)[3]

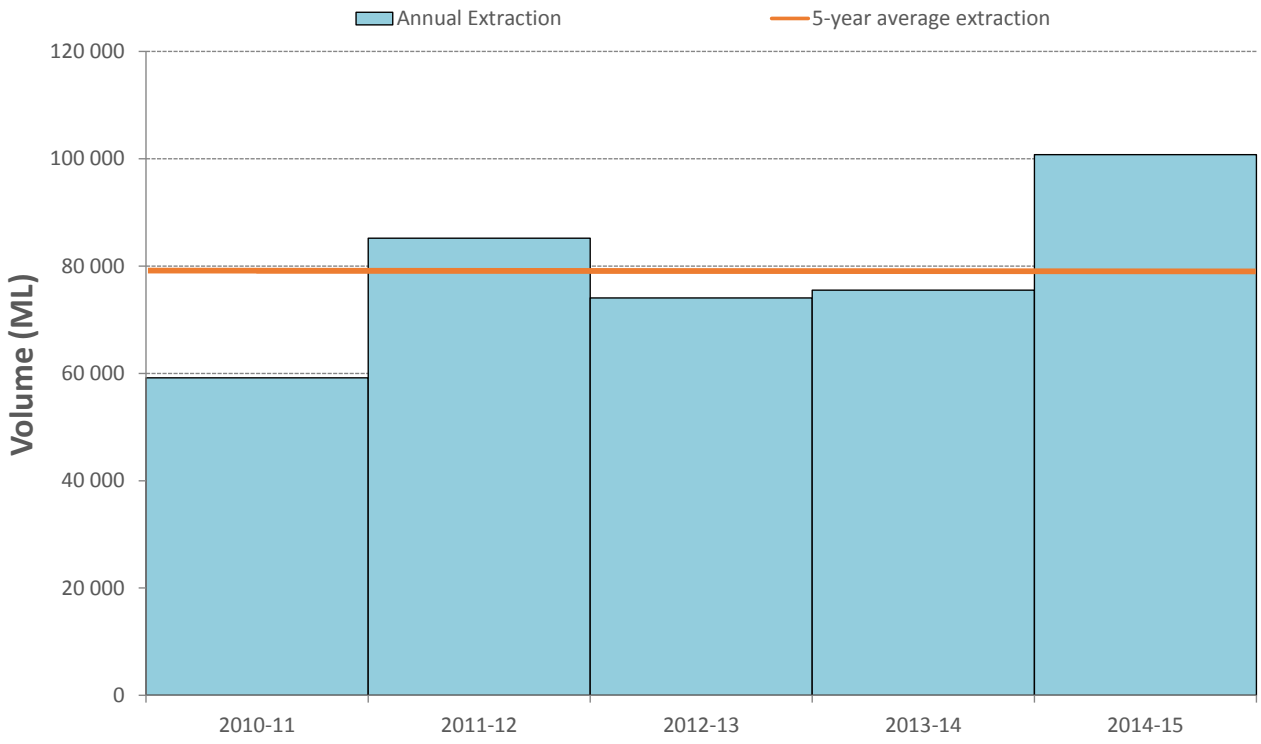


Figure 3. Licensed groundwater extraction volumes[4] for the past five water-use years, for the unconfined aquifer in the Tatiara Prescribed Wells Area

[3] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

[4] The licensed groundwater use for the 2014–15 water-use year is based on the best data available as of March 2016 and may be subject to change, as approximately three per cent of South East annual water use reports had not been submitted at that time. As such, the total licensed groundwater use may be higher than the volume presented in this report.

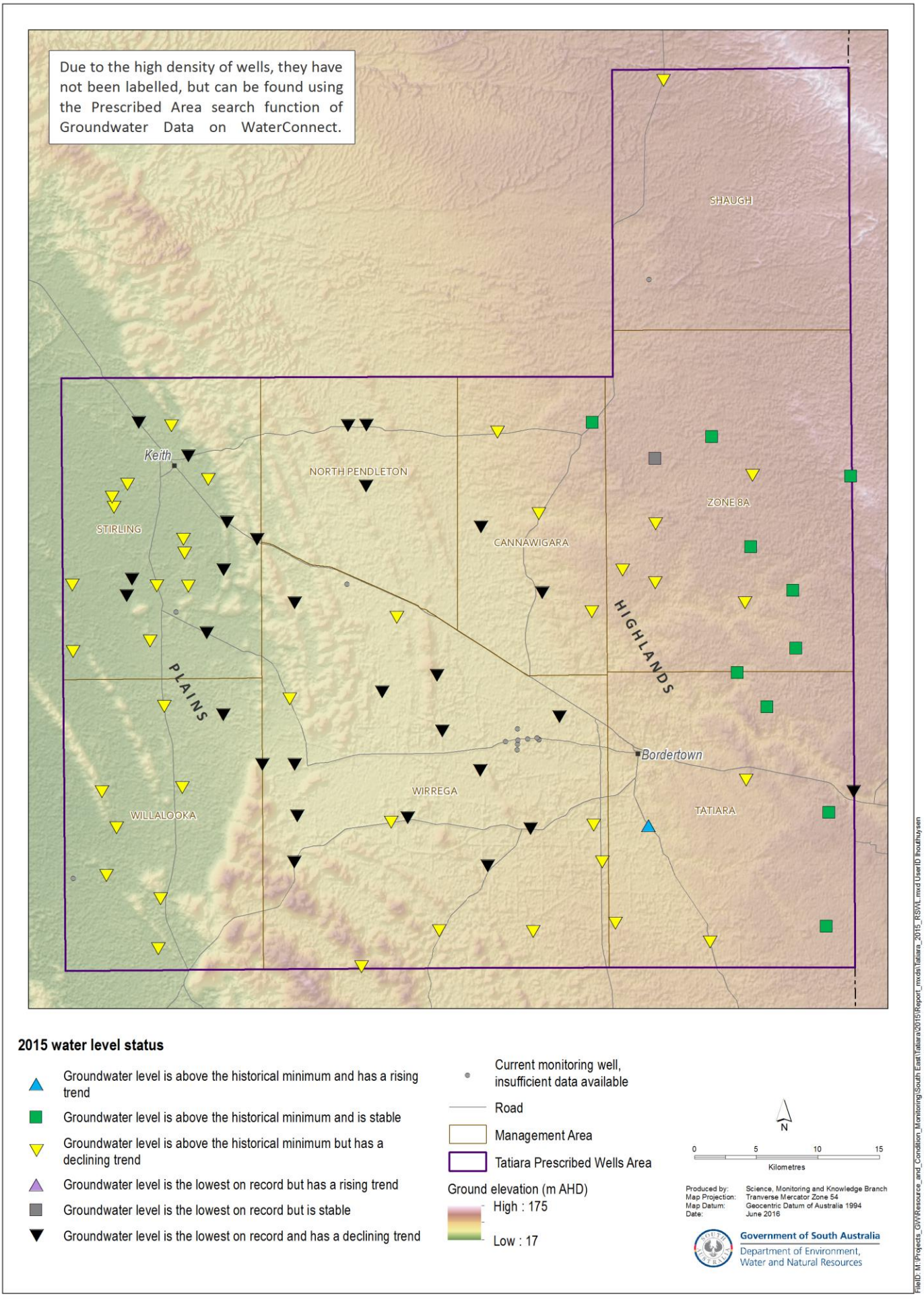


Figure 4. 2015 status of groundwater levels in the unconfined aquifer (Tatiara Prescribed Wells Area) based on the five-year water level trends from 2011 to 2015

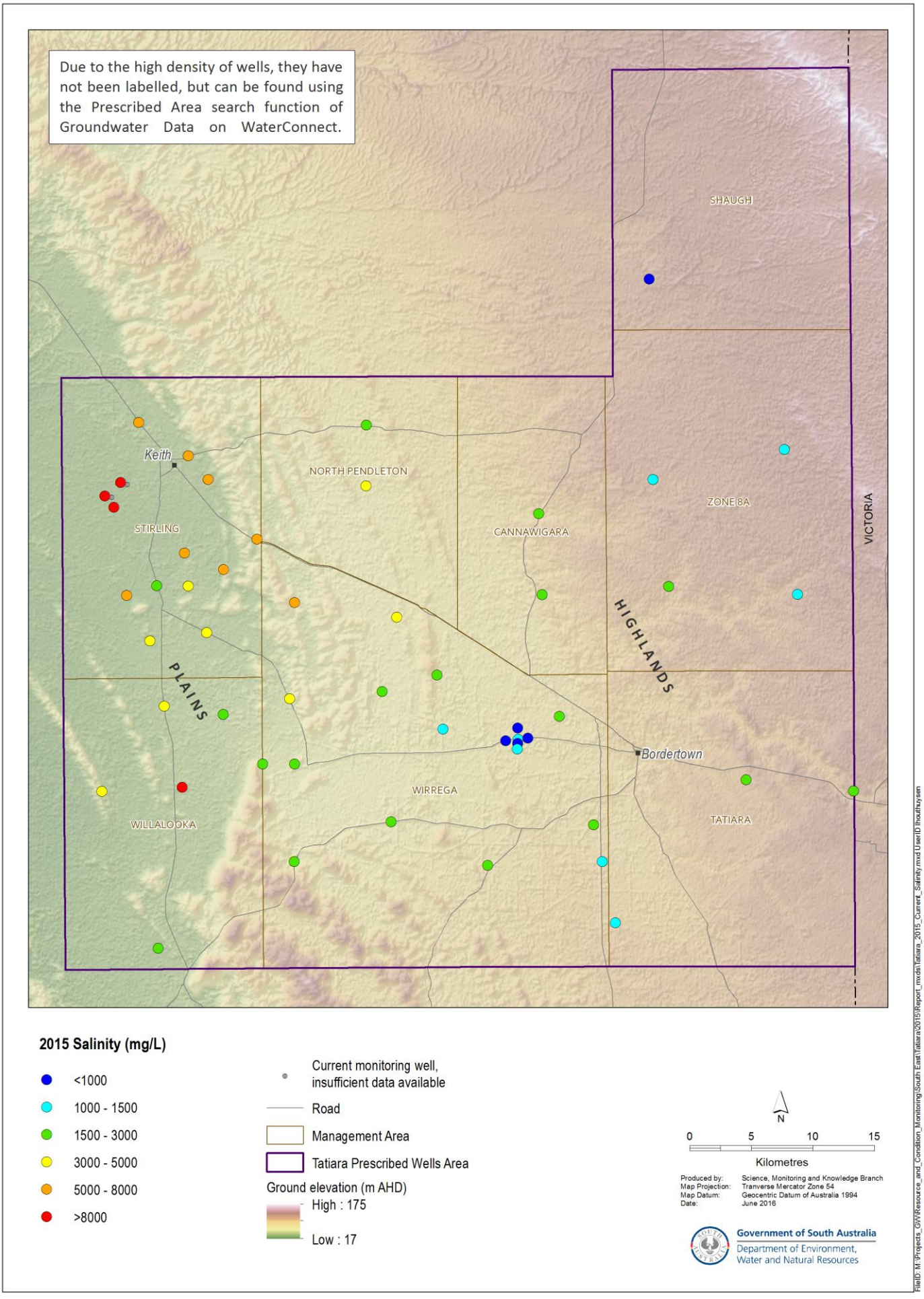


Figure 5. 2015 groundwater salinity of the unconfined aquifer (Tatiara Prescribed Wells Area)

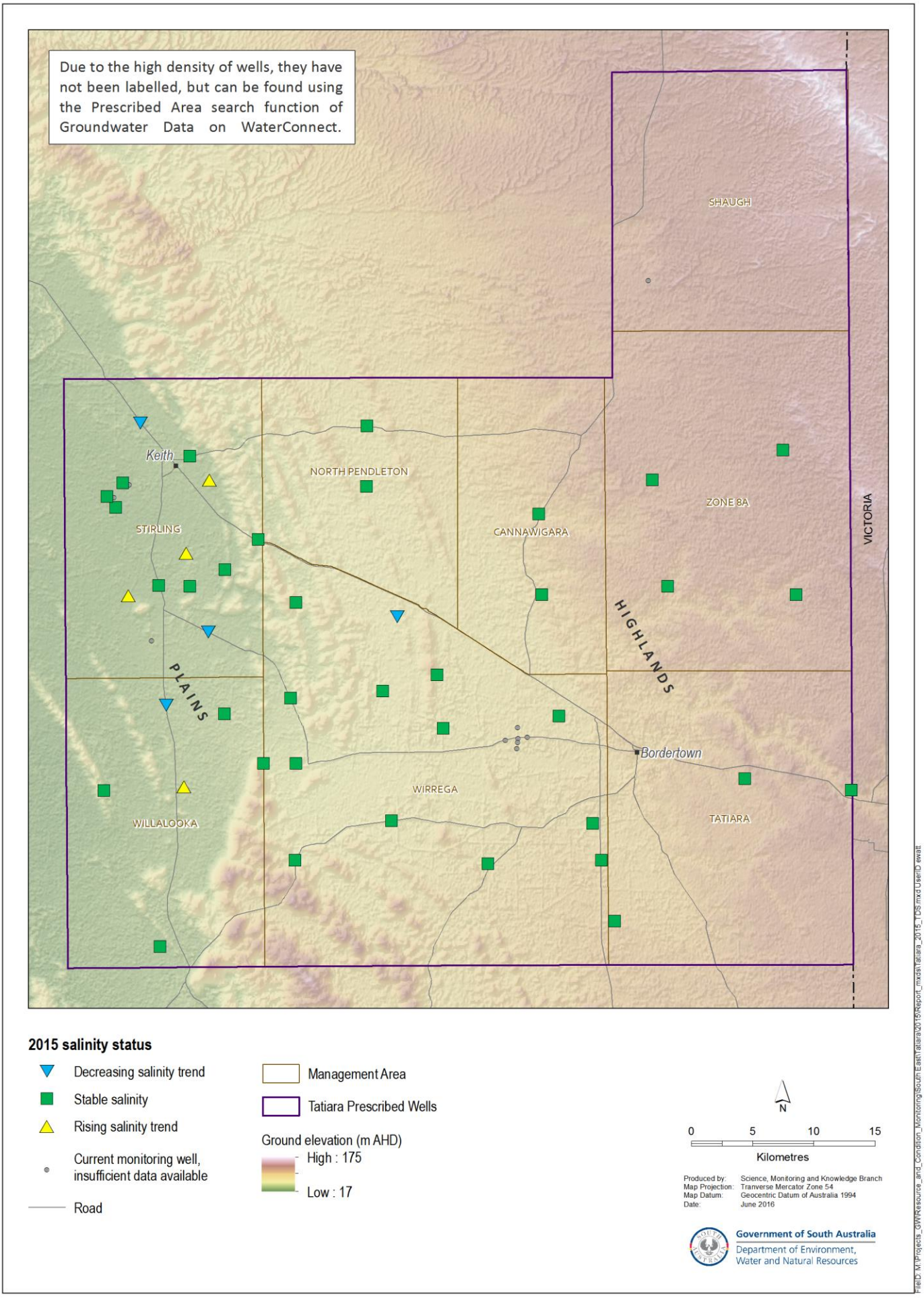


Figure 6. 2015 status of groundwater salinity in the unconfined aquifer (Tatiara Prescribed Wells Area) based on the five-year trends from 2011 to 2015